

CLAIMS

Claims 1-3, 5-23, 28-31, 34-43, 45-63, 68-70, 72-73, and 80-90 are pending in this application after entry of the amendments identified below.

1. (Currently amended) A method of caching in a system for transmitting a plurality of media data titles to one or more client(s) from a central server computer system and a proxy server computer system located in a computer network environment, said proxy server computer system located in the network between the central server computer system and the one or more client(s), wherein each media data title is divided into blocks to be transmitted to the one or more client(s) in a time sequence, and each block is divided into sub-blocks, comprising:

causing the central server computer system to transmit data in the media data titles to the proxy server computer system via a backbone network connection, and the proxy server computer system to transmit data in the media data titles to one or more client(s) via a local network connection;

identifying which sub-blocks from different blocks of each media data title that are to be cached, wherein the identified sub-blocks include some but not all sub-blocks in each of that are distributed over the blocks of at least one media data title;

caching only the identified sub-blocks at the proxy server computer system to reduce the transmission bit rate of the central server computer system in the network environment for transmitting data in the media data titles to the proxy server computer system; and

combining sub-blocks of a media data title cached at the proxy server computer system with sub-blocks of the media data title not cached at the proxy server computer system and transmitted from the central server to the proxy server computer system through the network, for delivery to the one or more client(s), wherein a peak transmission rate in the backbone network connection for the central server computer system to transmit data in the titles to the proxy server computer system is reduced.

2. (Previously presented) The method of claim 1, wherein the cached sub-blocks are cached for time periods that are independent of time.

3. (Original) The method of claim 1, wherein the caching caches substantially the same number of sub-blocks from each block of said at least one title.

4. (Cancelled).

5. (Original) The method of claim 1, wherein the media titles include video titles, and the sub-blocks comprise partial information of video frames, wherein the video frames are to be transmitted sequentially, further comprising combining the partial information of video frames from the proxy server with complementary partial information of such video frames from the central server into complete video frames and sending the complete video frames to the client(s).

6. (Original) The method of claim 5, wherein the partial information comprise video information along some scan lines of video frames, further comprising combining the video information along such scan lines with complementary video information along other scan lines of such video frames from the central server into complete video frames and sending the complete video frames to the client(s).

7. (Original) The method of claim 5, wherein the partial information comprise video information obtained at a set of sampling times and at a first sampling rate lower than that of a video source from which said information originates, further comprising combining the video information at the lower first sampling rate from the proxy server with complementary video information taken at sampling times different from the set of sampling times of such video frames from the central server into video data at a sampling rate higher than the first sampling rate and sending the video data at the higher sampling rate to the client(s).

8. (Original) The method of claim 5, wherein the partial information comprise video information in a basic layer and the complementary partial information comprises video information in an enhancement layer, said basic and enhancement layers being defined according to spatial, signal-to-noise or temporal scalability.

9. (Original) The method of claim 1, wherein the identifying is made as a function of an access profile of the titles at the proxy.

10. (Original) The method of claim 1, wherein prior to any accesses of the titles by the client(s), an average caching approach utilizes storage at the proxy server by storing a substantially equal number of sub-blocks from each title.

11. (Original) The method of claim 1, wherein prior to any accesses of the titles by the client(s), a proportional caching approach utilizes access history data to determine how much of each title to cache.

12. (Original) The method of claim 1, wherein after the system starts operation, cache content at the proxy server will change from time to time to reflect actual access behavior.

13. (Original) The method of claim 1, further comprising beginning a caching process at the proxy server after receiving a title request from a client by ensuring there is sufficient bandwidth from said proxy to such client to deliver the request and if not, denying the request.

14. (Original) The method of claim 13, further comprising delivering the complete content of the requested title when such content is in local storage of said proxy server.

15. (Original) The method of claim 13, further comprising:
when said proxy server does not have complete content of the requested title, determining if there is sufficient available backbone bandwidth to carry said title from the central server to said proxy server and if not, rejecting the request.

16. (Original) The method of claim 15, further comprising activating a progressive caching process to adjust cache content at said proxy server to reflect the requested title.

17. (Original) The method of claim 1, further comprising replacing a cached portion of a particular title by deleting the most recently cached portion of such title.

18. (Original) The method of claim 1, further comprising deciding which titles shall be subject to caching replacement using a most current access profile as an indication of a future profile.

19. (Original) The method of claim 1, further comprising keeping track of each access request at the proxy server in order to determine which titles shall be subject to caching replacement.

20. (Original) The method of claim 1, further comprising deciding which titles shall be subject to caching replacement using a current access profile as an indication of the future profile, wherein said deciding includes:

defining a time window ending at the time of the caching replacement;

calculating an access frequency of each title in a storage of the proxy server, said access frequency being a function of the accesses to such title during the time window or a portion thereof; and

performing the caching replacement in response to the access frequencies of the titles in the storage.

21. (Original) The method of claim 20, wherein said access frequency is proportional to the sum of the accesses to such title during the time window or a portion thereof.

22. (Original) The method of claim 20, wherein said access frequency is proportional to a time-weighted sum of the accesses to such title during the time window or a portion thereof, with the time weighting in favor of accesses occurring more recently in the window.

23. (Original) The method of claim 1, further comprising detecting multiple ongoing requests from clients for a title received at different times during caching in response to an initial

request of said title, and increasing the number of sub-blocks cached from the blocks of at least one title in response to a subsequent request of said title.

24-27. (Cancelled)

28. (Currently amended) A system for delivering media information; the system comprising:

a plurality of proxy servers computer systems, each servicing a number of terminal devices via a local network connection and receiving a request from one of said terminal devices when a user of said one of said terminal devices desires for a media title among a plurality of media titles, said media data titles divided into units that are transmitted in a time sequence to one or more of the terminal devices; each of said proxy servers computer systems comprising a cache memory for storing information in units of at least some of the media titles; wherein amount of information in the number of units of each of said at least some media data titles stored and/or replaced in the cache memory is determined by a request frequency to said each of said media data titles; and

a central media server computer system coupled to said proxy servers computer systems via a backbone connection in a network environment, said proxy servers located in the network between the central server computer system and one or more client(s), wherein the central server computer system transmits data in the media data titles to the proxy servers computer systems, and each of the proxy servers computer systems transmits data in the media data titles to one or more terminal devices client(s);

said central media server computer system having a storage space for storing a plurality of said media data titles and providing data from one or more of said media data titles when receiving a proxy request from one of said proxy servers computer systems, wherein the units of at least one of said media titles containing information cached in the cache memory of said one proxy server computer system are divided into sub-blocks, and wherein the sub-blocks stored in the cache memory of said one proxy server computer system include some but not all sub-blocks in each of the units of said at least one media data titlesaid cache memory of said one proxy server caching only some but not all of the units of said one or more media titles,

said one proxy server combining the sub-blocks in cached units with uncached sub-blocks in units received through the network from the central server to form a data stream of complete media data title(s) and transmitting the combined sub-blocks in units of such media data title(s) to one or more client(s) terminal devices, so that the transmission bit rate of the central media server in the backbone connection of the network environment for transmitting data from the at least some media data titles to said one of the proxy servers is reduced.

29. (Currently amended) A system for delivering media information; the system comprising:

a plurality of proxy servers computer systems, each servicing a number of terminal devices and receiving a request from one of said terminal devices when a user of said one of said terminal devices desires a media title from a plurality of media titles; wherein at least one of said proxy server computer systems comprises a cache memory ~~storing a number but not all of units of at least one of said titles; wherein the units of the at least one title stored are distributed over such title;~~ and

a central server computer system coupled to said proxy server computer systems in a ~~network environment~~, said proxy server computer systems located in the network between the central server computer system and one or more client(s), wherein the central server computer system transmits data in the media data titles to the proxy server computer systems, and the proxy server computer systems transmit data in the media data titles to one or more client(s); said central server computer system having a storage space for storing a plurality of said titles and providing data from one of said titles when receiving a proxy request from said at least one of said proxy server computer systems, said cache memory of said at least one proxy server computer system caching only some but not all of the units of said at least one media title, said at least one proxy server computer system combining the cached units with uncached units received through the network from the central server computer system to form a data stream of a complete media title and transmitting such title to one or more client(s), so that the transmission bit rate of the central server computer system in the ~~network environment~~ for transmitting the at least one title to said at least one proxy server computer system is reduced, wherein said at least one of said media titles includes video frames to be transmitted in a time sequence, each frame being divided into sub-blocks, each of the sub-blocks comprising partial information of a video frame,

wherein said units of said at least one media title cached at said proxy server computer system comprise partial information of substantially all of the video frames in said at least one media title, so that said one proxy server computer system combines the cached partial information of substantially all of the video frames in said at least one media title with complementary partial information of such video frames from the central server computer system into complete video frames and sends the complete video frames to terminal devices.

30. (Currently amended) The system of claim 29, wherein said at least one proxy server computer system stores the units of the at least one title for time periods that are independent of time.

31. (Currently amended) The system of claim 29, wherein the at least one title is divided into blocks to be transmitted to the one or more user(s) in a time sequence, and each block is divided into sub-blocks, wherein the at least one proxy server computer system caches the same number of sub-blocks from each block of said at least one title.

32. – 33. (Cancelled).

34. (Currently amended) The system of claim ~~33~~29, wherein the partial information comprise video information along some scan lines of video frames, and wherein the at least one proxy server computer system combines the video information along such scan lines with complementary video information along other scan lines of such video frames from the central server computer system into complete video frames and sends the complete video frames to the user(s).

35. (Currently amended) The system of claim 33 wherein the partial information comprise video information obtained at a set of sampling times and at a first sampling rate lower than that of a video source from which said information originates, and wherein the at least one proxy server computer system combines the video information at the lower first sampling rate with complementary video information taken at sampling times different from the set of sampling times of such video frames from the central server computer system into video data at a

sampling rate higher than the first sampling rate and sends the video data at the higher sampling rate to the user(s).

36. (Original) The system of claim 32, wherein the sub-blocks comprise information in a base layer of a scalable multilayer system.

37. (Currently amended) The system of claim 29, where the number of units is a function of an access profile of the at least one title at the at least one proxy server computer system.

38. (Currently amended) A method of caching in a system for transmitting a plurality of media data titles to one or more client(s) from a central server computer system and a proxy server computer system in a network ~~environment~~, said proxy server computer system located in the network between the central server computer system and the one or more client(s), wherein each title is divided into blocks to be transmitted to the one or more client(s) in a time sequence, and each block is divided into sub-blocks, comprising:

identifying which sub-blocks from different blocks of each title that are to be cached, wherein the identified sub-blocks include sub-blocks that are distributed over the blocks of at least one title;

caching only the identified sub-blocks at the proxy server computer system to reduce the transmission bit rate of the central server computer system in the network ~~environment~~ for transmitting data in the data titles to the proxy server computer system; and

combining sub-blocks of a media data title cached at the proxy server computer system with sub-blocks of the title not cached at the proxy server computer system and transmitted from the central server computer system through the network to the proxy server computer system, for delivery to the one or more client(s), wherein the cached sub-blocks of at least one of said media titles comprise partial information of video frames, wherein the video frames are to be transmitted sequentially, and wherein said one proxy server computer system combines the cached partial information of video frames with complementary partial information of such video frames from the central server computer system into complete video frames and sends the complete video frames to the one or more client(s).

39. (Previously presented) The method of claim 38, wherein the cached sub-blocks are stored for time periods that are independent of time.

40. (Original) The method of claim 38, wherein the caching caches the same number of sub-blocks from each block of said at least one title.

41. (Currently amended) A computer readable storage device embodying a program of instructions executable by a computer to perform a method of caching in a system for transmitting a plurality of media data titles to one or more client(s) from a central server computer system and a proxy server computer system in a network-~~environment~~, said proxy server computer system located in the network between the central server computer system and the one or more client(s), wherein each title is divided into blocks to be transmitted to the one or more client(s) in a time sequence, and each block is divided into sub-blocks, said method comprising:

identifying which sub-blocks from different blocks of each title that are to be cached, wherein the identified sub-blocks include sub-blocks that are distributed over the blocks of at least one title;

caching the identified sub-blocks under the control of the proxy server computer system to reduce the transmission bit rate of the central server computer system in the network ~~environment~~ for transmitting data in the media data titles to the proxy server computer system; and

combining sub-blocks of a title cached at the proxy server computer system with sub-blocks of the title not cached at the proxy server computer system and transmitted from the central server computer system through the network to the proxy server, wherein the cached sub-blocks of at least one of said media titles comprise partial information of video frames, wherein the video frames are transmitted sequentially for delivery to the one or more client(s), and wherein said one proxy server computer system combines the cached partial information of video frames with complementary partial information of such video frames from the central server computer system into complete video frames and sends the complete video frames to the one or more client(s).

42. (Previously presented) The device of claim 41, wherein the cached sub-blocks are stored for time periods that are independent of time.

43. (Original) The device of claim 41, wherein the caching caches substantially the same number of sub-blocks from each block of said at least one title.

44. (Cancelled).

45. (Currently amended) The device of claim 41, wherein the media titles include video titles, and the sub-blocks comprise partial information of video frames, wherein the video frames are to be transmitted sequentially, said method further comprising combining the partial information of video frames from the proxy server computer system with complementary partial information of such video frames from the central server computer system into complete video frames and sending the complete video frames to the client(s).

46. (Currently amended) The device of claim 45, wherein the partial information comprise video information along some scan lines of video frames, said method further comprising combining the video information along such scan lines with complementary video information along other scan lines of such video frames from the central server computer system into complete video frames and sending the complete video frames to the client(s).

47. (Currently amended) The device of claim 45, wherein the partial information comprise video information obtained at a set of sampling times and at a first sampling rate lower than that of a video source from which said information originates, said method further comprising combining the video information at the lower first sampling rate from the proxy server computer system with complementary video information taken at sampling times different from the set of sampling times of such video frames from the central server computer system into video data at a sampling rate higher than the first sampling rate and sending the video data at the higher sampling rate to the client(s).

48. (Original) The device of claim 45, wherein the partial information comprise video information in a basic layer and the complementary partial information comprises video information in an enhancement layer, said basic and enhancement layers being defined according to spatial, signal-to-noise or temporal scalability.

49. (Currently amended) The device of claim 41, wherein the identifying is made as a function of an access profile of the titles at the proxy server computer system.

50. (Currently amended) The device of claim 41, wherein prior to any accesses of the titles by the client(s), an average caching approach utilizes storage at the proxy server computer system by storing a substantially equal number of sub-blocks from each title.

51. (Original) The device of claim 41, wherein prior to any accesses of the titles by the client(s), a proportional caching approach utilizes access history data to determine how much of each title to cache.

52. (Currently amended) The device of claim 41, wherein after the system starts operation, cache content at the proxy server computer system will change from time to time to reflect actual access behavior.

53. (Currently amended) The device of claim 41, said method further comprising beginning a caching process at the proxy server after receiving a title request from a client by ensuring there is sufficient bandwidth from said proxy server computer system to such client to deliver the request and if not, denying the request.

54. (Currently amended) The device of claim 53, said method further comprising delivering the complete content of the requested title when such content is in local storage of said proxy server computer system.

55. (Currently amended) The device of claim 53, said method further comprising:
when said proxy server does not have complete content of the requested title, determining if there is sufficient available backbone bandwidth to carry said title from the central server computer system to said proxy server computer system and if not, rejecting the request.

56. (Currently amended) The device of claim 55, said method further comprising activating a progressive caching process to adjust cache content at said proxy server computer system to reflect the requested title.

57. (Original) The device of claim 41, said method further comprising replacing a cached portion of a particular title by deleting the most recently cached portion of such title.

58. (Original) The device of claim 41, said method further comprising deciding which titles shall be subject to caching replacement using a most current access profile as an indication of a future profile.

59. (Currently amended) The device of claim 41, said method further comprising keeping track of each access request at the proxy server computer system in order to determine which titles shall be subject to caching replacement.

60. (Currently amended) The device of claim 41, said method further comprising deciding which titles shall be subject to caching replacement using a current access profile as an indication of the future profile, wherein said deciding includes:

defining a time window ending at the time of the caching replacement;

calculating an access frequency of each title in a storage of the proxy server computer system, said access frequency being a function of the accesses to such title during the time window or a portion thereof; and

performing the caching replacement in response to the access frequencies of the titles in the storage.

61. (Original) The device of claim 60, wherein said access frequency is proportional to the sum of the accesses to such title during the time window or a portion thereof.

62. (Original) The device of claim 60, wherein said access frequency is proportional to a time-weighted sum of the accesses to such title during the time window or a portion thereof, with the time weighting in favor of accesses occurring more recently in the window.

63. (Original) The device of claim 41, said method further comprising detecting multiple ongoing requests from clients for a title received at different times during caching in response to an initial request of said title, and increasing the number of sub-blocks cached from the blocks of at least one title in response to a subsequent request of said title.

64-67. (Cancelled)

68. (Currently amended) A method for transmitting a program of instructions executable by a computer to perform a process of caching in a system for transmitting a plurality of media data titles to one or more client(s) from a central server computer system and a proxy server computer system in a network-~~environment~~, said proxy server computer system located in the network between the central server computer system and the one or more client(s), wherein each title is divided into blocks to be transmitted to the one or more client(s) in a time sequence, and each block is divided into sub-blocks, said method comprising:

transmitting to a client device a program of instructions; and

enabling the client device to perform, by means of such program, the following process:

identifying which sub-blocks from different blocks of each title that are to be cached, wherein the identified sub-blocks include sub-blocks that are distributed over the blocks of at least one title; and

caching the identified sub-blocks under the control of the proxy server to reduce the transmission bit rate of the central server computer system in the network ~~environment~~ for transmitting data in the media data titles to the proxy server computer system; and

combining sub-blocks of a title cached at the proxy server computer system with sub-blocks of the title not cached at the proxy server computer system and transmitted from the

central server computer system through the network to the proxy server computer system, for delivery to the one or more client(s), wherein at least one of said media titles cached includes a title divided into blocks to be transmitted in a time sequence, and each block is divided into sub-blocks some of which are cached, and the cached sub-blocks comprise partial information of video frames, wherein the video frames are to be transmitted sequentially, and wherein said proxy server computer system combines the partial information of video frames with complementary partial information of such video frames from the central server computer system into complete video frames and sends the complete video frames to client(s).

69. (Previously presented) The method of claim 68, wherein the program enables the cached sub-blocks to be stored for time periods that are independent of time.

70. (Original) The method of claim 68, wherein the program enables the caching to cache substantially the same number of sub-blocks from each block of said at least one title.

71. (Cancelled).

72. (Original) The method of claim 71, wherein the partial information comprise video information in a basic layer and the complementary partial information comprises video information in an enhancement layer, said basic and enhancement layers being defined according to spatial, signal-to-noise or temporal scalability.

73. (Original) The method of claim 68, wherein the identifying is made as a function of an access profile of the titles at the proxy.

74-79. (Cancelled)

80. (Previously presented) The system of claim 29, wherein the central server transmits data in the media data titles to the at least one proxy server via a backbone network connection, and the at least one proxy server transmits data in the media data titles to one or more client(s) via a local network connection, and wherein a peak transmission rate in the

backbone network connection for the central server to transmit data from the at least some titles to the at least one proxy server is reduced.

81. (Previously presented) The method of claim 38, further comprising causing the central server to transmit data in the data titles to the proxy server via a backbone network connection, and the proxy server to transmit data in the data titles to one or more client(s) via a local network connection; wherein a peak transmission rate in the backbone network connection for the central server to transmit data in the titles to the proxy server is reduced.

82. (Previously presented) The device of claim 41, said method further comprising causing the central server to transmit data in the data titles to the proxy server via a backbone network connection, and the proxy server to transmit data in the data titles to one or more client(s) via a local network connection; wherein a peak transmission rate in the backbone network connection for the central server to transmit data in the titles the proxy server is reduced.

83. (Previously presented) The method of claim 68, further comprising causing the central server to transmit data in the data titles to the proxy server via a backbone network connection, and the proxy server to transmit data in the media data titles to one or more client(s) via a local network connection;

wherein a peak transmission rate in the backbone network connection for the central server to transmit data in the titles to the proxy server is reduced.

84. (New) The method of claim 38, said sub-blocks of said at least one media title cached at said proxy server computer system comprise partial information of substantially all of the video frames in said at least one media title.

85. (New) The device of claim 41, said sub-blocks of said at least one media title cached at said proxy server computer system comprise partial information of substantially all of the video frames in said at least one media title.

86. (New) The method of claim 68, said sub-blocks of said at least one media title cached at said proxy server computer system comprise partial information of substantially all of the video frames in said at least one media title.

87. (New) A method of caching in a system for transmitting a plurality of media data titles to one or more client(s) from a central server computer system and a proxy server computer system located in a computer network, said proxy server computer system located in the network between the central server computer system and the one or more client(s), wherein each media data title is divided into blocks each divided into sub-blocks comprising partial information of video frames, wherein the video frames are to be sequentially transmitted to the one or more client(s), comprising:

causing the central server computer system to transmit data in the media data titles to the proxy server computer system via a backbone network connection, and the proxy server computer system to transmit data in the media data titles to one or more client(s) via a local network connection;

identifying which sub-blocks from different blocks of each media data title that are to be cached, wherein the identified sub-blocks include some but not all sub-blocks in each of the blocks of at least one media data title;

caching only the identified sub-blocks at the proxy server computer system to reduce the transmission bit rate of the central server computer system in the backbone network connection for transmitting data in the at least one media data title to the proxy server computer system; and

transmitting sub-blocks of the media data titles cached at the proxy server computer system to the one or more client(s).

88. (New) The method of claim 87, wherein said blocks comprise video frames , and the sub-blocks comprise video information along some scan lines of the video frames so that the transmitting transmits some scan lines of the video frames.

89. (New) The method of claim 87, wherein said transmitting transmits some scan lines that are evenly spaced across the video frames.

90. (New) The method of claim 87, said sub-blocks of said at least one media title cached at said proxy server computer system comprise partial information of substantially all of the video frames in said at least one media title.

Summary of Telephonic Interview on July 20, 2005

The undersigned appreciates the telephonic interview on July 20, 2005 granted by Examiners Marc Thompson and Jerry Dennison. Claims 1, 28 and 29 were discussed and US Patent 5,815,662 to Ong.

The undersigned explained that in claims 1 and 28, the sequentially transmitted data blocks of a media title are divided into sub-blocks as shown in Fig. 3B of the present application. In the example given in pages 19 and 20 of the present application in reference to Fig. 3B, the first sub-block of each of the 100 data blocks of the media title (forming unit 132a) are cached. Then, if there is demand for this title by customers, the second sub-block of each of the 100 data blocks of the media title (forming unit 134a) are cached. Then, only the remaining uncached sub-blocks would need to be transmitted from the central server. In claim 1, at least some but not all of the sub-blocks in each of the data blocks of the media title are cached at the proxy server computer system.¹ It was also explained in connection with approaches A and C in Fig. 3A of the present application, that by caching a portion of each data block as in approach C, the peak data rate required of the backbone connection for transmitting from the central server to the proxy server is reduced. In approach C, where $\frac{1}{4}$ of the sub-blocks are cached, the peak data rate is reduced from r to $0.75r$. This is not true in Ong, who fails to divide data blocks into sub-blocks at all. Ong caches entire data blocks. Thus, similar to approach A, when a data block is not cached and must come from the disk drive in Ong, the full data rate is required by Ong, so that the peak data rate is not reduced.

It was also explained that Ong discloses caching at a buffer memory data that is stored at a disk drive, instead of caching at a proxy server computer system data from a central server computer system. A disk drive is different from the central server computer system of claim 1.

The undersigned also clarified that on page 30, lines 16-24, it was explained that the cached sub-blocks can be comprised of scan lines of a video frame. In the example illustrating such feature, if $\frac{1}{4}$ of the scan lines of each video frame is cached, then only $\frac{3}{4}$ of the scan lines would need to be transmitted from the central server to the proxy server. This would reduce the

¹ The scope of claim 1 is, of course, not limited by this example on pages 19 and 20 of the present application. In other words, the number of sub-blocks cached from the various different data blocks of the media title may be different and not the same.

peak transmission data rate by $\frac{1}{4}$. This feature is captured in claim 29, whose scope is of course not limited to this particular example. This feature of claim 29 is not disclosed by Ong.²

The undersigned understands that there appears to be allowable subject matter in claims 1, 28 and 29, presumably in view of the prior art already of record at this time, subject to a further patent search.

² It is also not disclosed in any art of record.